New Hampshire Volunteer Lake Assessment Program

2003 Biennial Report for Pawtuckaway Lake Nottingham

NHDES
Water Division
Watershed Management Bureau
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Concord, NH 03301

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **PAWTUCKAWAY LAKE, NOTTINGHAM,** the program coordinators have made the following observations and recommendations:

Thank you for your continued hard work sampling the lake/pond this season! Your monitoring group sampled **five** times this season and has done so for many years! As you know, with multiple sampling events each season, we will be able to more accurately detect changes in water quality. Keep up the good work!

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

  Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.**

  ### NORTH STATION

  The current year data (the top graph) show that the chlorophyll-a concentration ***decreased consistently*** from May to July, ***increased*** from July to August, and then ***decreased*** from August to September. The chlorophyll-a concentration in May was ***slightly greater than*** the state mean, while the concentration in June, July, August, and September was ***much less than*** the state mean.

The historical data (the bottom graph) show that the 2003 chlorophyll-a mean is ***less than*** the state mean.

Overall, the statistical analysis of the historical data show that the chlorophyll-a concentration has ***significantly increased*** **at the North Station** since monitoring began. Specifically, the chlorophyll-a concentration has ***increased*** (meaning ***worsened***) on average by *approximately* ***3.6 percent*** per sampling season during the sampling period **1988** to **2003.** (Note: Please refer to Appendix E for the statistical analysis explanation and data print out.)

SOUTH STATION

The current year data (the top graph) show that the chlorophyll-a concentration ***decreased*** from May to June, ***increased*** from June to July, and then remained ***approximately stable*** from July to September. The chlorophyll-a concentration on each sampling event was ***less than*** the state mean.

Overall, the statistical analysis of the historical data (the bottom graph) shows that the mean annual chlorophyll-a concentration has ***not significantly changed*** (either *increased* or *decreased*) since monitoring began. Specifically, the chlorophyll-a concentration has ***fluctuated***, but has not *continually increased* or *continually decreased* since monitoring began in **1992**. (Note: Please refer to Appendix E for the detailed statistical analysis explanation and data print out.)

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Algal concentrations may increase with an increase in nonpoint sources of phosphorus loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). Therefore, it is extremely important for volunteer monitors to continually educate residents about how activities within the watershed can affect phosphorus loading and lake/pond quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the lake/pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

NORTH STATION

The current year data (the top graph) show that the in-lake transparency ***increased*** from May to June, ***decreased slightly*** from June to July, and then ***increased consistently*** from July to September. The transparency in August and September was ***slightly greater than*** the state mean.

The historical data (the bottom graph) show that the 2003 mean transparency is ***approximately equal to*** the state mean.

Overall, the statistical analysis of the historical data (the bottom graph) show that the mean annual in-lake transparency has ***not significantly changed*** (either *continually increased* or *continually decreased*) since monitoring began. Specifically, the in-lake transparency has remained ***relatively stable, ranging between 3 and 4 meters,*** and since 1988. (Note: Please refer to Appendix E for the statistical analysis explanation and data print out.)

SOUTH STATION

The current year data (the top graph) show that the in-lake transparency ***increased*** from May to June, ***decreased*** from June to July, and then ***increased consistently*** from July to September. In May, the transparency was ***less than*** the state mean. In July the transparency was ***approximately equal to*** the state mean. In June, August, and September, the transparency was ***slightly greater than*** the state mean.

The historical data (the bottom graph) show that the 2003 mean transparency is ***slightly greater than*** the state mean.

Overall, the statistical analysis of the historical data (the bottom graph) show that the mean annual in-lake transparency has ***not significantly changed*** (either *continually increased* or *continually decreased*) since monitoring began. Specifically, the in-lake transparency has remained ***relatively stable, ranging between 3***

and 4 meters since 1988. (Note: Please refer to Appendix E for the statistical analysis explanation and data print out.)

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

  Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

  NORTH STATION

  The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***increased slightly*** from May to June, ***decreased*** from June to July, ***remained stable*** from July to August, and then ***decreased*** from August to September. The phosphorus concentration in May and June was ***greater than*** the state median, in July and August was ***approximately equal to*** the state median, and in September was ***less than*** the state median.

  The historical data show that the 2003 mean epilimnetic phosphorus concentration is ***slightly greater than*** the state median.

  The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***increased consistently*** from May to September. The phosphorus concentration on each sampling event was ***greater than*** the state median.

Overall, the statistical analysis of the historical data show that the phosphorus concentration in the epilimnion (upper layer) and in the hypolimnion has ***significantly increased*** since monitoring began. Specifically, the phosphorus concentration in the epilimnion has ***increased*** (meaning ***worsened***) on average at a rate of ***approximately 2.7 percent per season*** during the sampling period **1988** to **2003.** The phosphorus concentration in the hypolimnion has ***increased*** (meaning ***worsened***) on average at a rate of ***approximately 8.0 percent per season*** during the sampling period **1988** to **2003** (Please refer to Appendix E for the statistical analysis explanation and data print out).

It is important to point out that the phosphorus concentration in the hypolimnion of the **NORTH STATION** ***increased*** as the summer progressed, and is ***much greater than*** in the epilimnion. In addition, the phosphorus concentration in the hypolimnion at the **NORTH STATION** is ***much greater than*** in the hypolimnion at the **SOUTH STATION.** This data indicates that ***internal total phosphorus loading*** is occurring in the hypolimnion at the **NORTH STATION** deep spot. (Please refer to the discussion of Table 9 and 10 for a detailed explanation of internal total phosphorus loading.)

SOUTH STATION

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***increased*** from May to June, ***decreased*** from June to September, and then ***remained stable*** from August to September. The phosphorus concentration in May, June, and July was either ***equal to*** or ***greater than*** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***increased consistently*** from May to July, ***decreased*** from July to August, and then remained ***approximately stable*** from August to September. The phosphorus concentration in June and July was ***equal to*** or ***greater than*** the state median. In August and September the total phosphorus concentration was ***less than*** the state median.

The historical data show that the 2003 mean epilimnetic and hypolimnetic phosphorus concentration is ***approximately equal to*** the state median.

Overall, the statistical analysis of the historical data show that the phosphorus concentration in the epilimnion (upper layer) and the hypolimnion (lower layer) has ***not significantly changed*** (either *increased* or *decreased*) since monitoring began. Specifically, the phosphorus concentration in the epilimnion and hypolimnion has ***fluctuated,*** but has not *continually increased* or *continually decreased* since monitoring began in 1992.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands.

TABLE INTERPRETATION

- **Table 2: Phytoplankton**

  Table 2 (Appendix B) lists the current and historic phytoplankton species observed in the lake/pond.

  NORTH STATION: The dominant phytoplankton species observed this year were ***Ceratium*** **(a dinoflagellate),** ***Mallomonas*** **(a golden-brown algae),** ***and Tabellaria*** **(a diatom).**

  SOUTH STATION: The dominant phytoplankton species observed this year were ***Ceratium*** **(a dinoflagellate),** ***Mallomonas*** **(a golden-brown algae),** ***and Oscillatoria*** **(a cyanobacteria).**

  Phytoplankton populations undergo a natural succession during the growing season (Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire's less productive lakes and ponds.

  Cyanobacteria can reach nuisance levels when excessive nutrients and favorable environmental conditions occur. During September of 2003, a few lakes and ponds in the southern portion of the state experienced cyanobacteria blooms. This was likely due to nutrient loading to these waterbodies. As mentioned previously, many weeks during the Spring and Summer of 2003 were rainy, which likely resulted in a large amount of nutrient loading to surface waters.

  The presence of cyanobacteria serves as a reminder of the lake's/pond's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading into the lake/pond by eliminating fertilizer use on lawns, keeping the lake/pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the lake/pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria (blue-green algae) have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to “pile” cyanobacteria into scums that accumulate in one section of the lake/pond. If a fall bloom occurs, please contact the VLAP Coordinator.

- **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire’s lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the “Chemical Monitoring Parameters” section of this report.

The mean pH at both of the deep spots this season ranged from approximately **5.9** in the hypolimnion to **6.6** in the epilimnion, which means that the water is ***slightly acidic.***

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH.

- **Table 5: Acid Neutralizing Capacity**

Table 5 (Appendix B) presents the current year and historic epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire’s lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are “highly sensitive” to acidic inputs. For a more detailed explanation, please refer to the “Chemical Monitoring Parameters” section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) of the **NORTH STATION (3.50 mg/L)** and the **SOUTH STATION (3.76 mg/L**), was ***less than*** the state mean. The data indicate that the lake is ***highly sensitive*** to acidic inputs (such as acid precipitation).

- **Table 6: Conductivity**

Table 6 (Appendix B) presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The mean conductivity value for New Hampshire's lakes and ponds is **62.1 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

While the conductivity is still ***relatively low*** (approximately 40 – 60 uMhos/cm) in the lake and in **most** of the tributaries), the conductivity has ***gradually increased*** in the lake/pond at both deep spots and in the inlets since monitoring began.

In addition, the conductivity in **#07 White Grove Brook**, **#08 Fernalds A** and **#08F Upstream** continues to be ***elevated*** (approximately 150 – 250 uMhos/cm).

Typically, sources of elevated conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake/pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

We recommend that your monitoring group *continue* to conduct stream surveys and storm event sampling along the inlets with elevated conductivity so that we can *better* determine what may be causing the increases.

- **Table 8: Total Phosphorus**

Table 8 (Appendix B) presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The total phosphorus concentration continued to be ***very high*** in the samples collected from **#08 Fernalds A** and **#08F Upstream** (in the 500 – 2000 ug/L range).

The turbidity (Table 11) in the samples collected from **#08 Fernalds A** and **#08F Upstream** continued to be ***elevated*** this season, which suggests that erosion is occurring in this portion of the watershed and/or that there is a large concentration of algal cells in the water in these locations.

- **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**
  Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  The dissolved oxygen concentration was ***low in the hypolimnion*** at the **NORTH** and **SOUTH** deep spot of the lake/pond. As lakes/ponds age, and as the summer progresses, oxygen becomes ***depleted*** in the hypolimnion (the lower layer) by the process of decomposition.

  In addition, during this season, and many past sampling seasons the lake/pond has had a lower dissolved oxygen concentration and a higher total phosphorus concentration in the hypolimnion (the lower layer) than in the epilimnion (the upper layer), particularly at the **NORTH STATION** deep spot. These data suggest that the process of ***internal total phosphorus loading*** (commonly referred to as ***internal loading***) is occurring in the lake/pond. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion **(as it was this season and in many past seasons)**, the phosphorus that is normally bound up with metals in the sediment may be re-released into the water column. Depleted oxygen concentration in the hypolimnion of thermally stratified lakes/ponds typically occurs as the summer progresses.

  The ***low*** oxygen level in the hypolimnion is a sign of the lake's/pond's ***aging*** and ***declining*** health. This year the DES biologist conducted the temperature/dissolved oxygen profile in ***August.*** We recommend that the annual biologist visit for the 2004 sampling season be scheduled during ***June*** so that we can determine if oxygen is depleted in the hypolimnion ***earlier*** in the sampling season.

- **Table 11: Turbidity**
  Table 11 (Appendix B) lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the "Other Monitoring Parameters" section of this report for a more detailed explanation.

  As discussed previously, the turbidity (Table 11) in the samples collected from **#08 Fernalds A** and **#08F Upstream** continued to be elevated this season, which suggests that erosion is occurring in this portion of the watershed and/or that there is a large amount of algal cells in the water in these locations.

  In addition, the turbidity of the **NORTH STATION** hypolimnion (lower layer) sample was elevated (27.1 NTUs) on the **September** sampling event. This suggests that the lake/pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling. When the lake/pond bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting the hypolimnion sample, please check to make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

- **Other Sampling Activities/Watershed Investigations**
  DES and the Pawtuckaway Lake Association have worked cooperatively on numerous water quality projects over the past several years. Most recently, DES has taken the lead role in evaluating the Pawtuckaway Lake State Park septic system and evaluating/implementing the Batchelder Farm Best Management Practices (BMPs) for water quality.

  In April of 2003, DES met with State Park Officials to inspect the Pawtuckaway Lake septic system including the bath house, septic tanks, pumps and leach field. The DES inspection found the system to be fully functional with no sign of damage or failure. The septic system, built in 1965 serves the beach bath house. Waste from the bath house is delivered to a 10,000 gallon tank and pump chamber system. From there, effluent is pumped to approximately one-quarter mile to an upland leach field.

  Also during 2003, the Pawtuckaway Lake Association took the lead in pursuing the potential of community septic systems for lakefront residents, review of local zoning which may have a detrimental lake impact and organizing the Back Creek Subwatershed Land Protection Research.

Since 1999, staff from DES and the Natural Resource Conservation Service (NRCS) have been working with the owners of the Batchelder Farm, which is located near Fernald's Brook, to implement best management practices (BMPs) to address sources of nonpoint source pollution. Many BMPs have been implemented and some are a still work-in-progress. Below is a summary of the BMPs that have been implemented and follow up sampling that has occurred. DES will continue to coordinate efforts with the NRCS to ensure that all BMPs are installed and maintained as recommended.

October 1999:

- Constructed wetland with rock-lined outlet installed for the treatment of milkhouse waste.

- Cows fenced out of the existing pond and vegetated buffer established. (However, during the fall of 2002, DES observed that the fence has been removed so that the well can be accessed. DES will contact NRCS to determine if/when the fencing will be re-installed.)

- Earthen diversion installed below constructed wetland area to reduce slope length and increase the detention time for (and subsequent treatment of) barnyard runoff.

- Runoff and erosion control measures installed on the gravel road accessing the rear of the barn (where manure is stockpiled). Previous access was seasonal, not allowing for timely removal of "raw compost".

April 2000:

- Greenhouse-type barn erected to provide confinement of replacement heifers.

May 2000:

- Owners purchase 58 acres directly across the street from the home farm (eastside of Rte 156).

- Composted manure bagged and sold commercially at 2 separate locations in Nottingham. Very successful!

June 2000:

- Batchelder Farm approved for funding provided through the Environmental Quality Incentive Program (EQIP) to construct a concrete containment area for "raw compost" (manure and bedding stockpiled on the farm after removal from the barns and prior to transport off the site). The formation of windrows and the composting process itself takes place at owner's father's farm on

Route 152, and is outside the Pawtuckaway Lake watershed. EQIP funding will also be used to complete the roof over the "milker" feedlot constructed in 1997.

2001 - 2002:

- Roofing over the "milker" feedlot and fencing a small turn-out area was installed. Fencing was to be re-established adjacent to the barn (by November 2002) to keep cows out of constructed wetland area. DES has contacted NRCS for dimensions of the roof structure and linear feet of fencing placed. In addition DES will contact NRCS for future BMP plans for the site.

2003:

- To evaluate the effectiveness of the BMPs and compliance with State Water Quality Standards, DES conducted a source survey of potential pollution sources generated by Batchelder Farm. The survey included sample site documentation by global positioning system (GPS), photo, and sample site location and description. In addition, each site was mapped and marked with orange flagging in the field to make it easier to find the sample sites.

  Samples were collected in June, July and September. Preliminary findings indicate that minimal surface water runoff from Batchelder Farm directly impacts Pawtuckaway Lake during the summer and fall. However, additional samples will be collected in the spring during a period of heavy runoff with little nutrient uptake to eliminate Batchelder Farm as a contributing source of phosphorus to Pawtuckaway Lake.

- Fencing re-established adjacent to the barn to keep cows out of constructed wetland area.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your lake/pond, the biologist conducted a "Sampling Procedures Assessment Audit" for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor's Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors are not following the proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an ***excellent*** job collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

Sample Receipt Checklist

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an ***excellent*** job when collecting samples and submitting them to the laboratory this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

NOTES

NORTH STATION

- **Monitor's Note (9/9/03):** 2 stream locations were dry
  (9/12/03): Water seemed unseasonably warm

- **Biologist's Note (5/13/03):** Extremely high total phosphorous in #08F Upstream.
  (6/10/03): Extremely elevated total phosphorous concentration in #08F Upstream.
  (7/8/03): The conductivity for Round Pond Brook was not run in the laboratory. We apologize for this omission.
  (8/12/03): The phosphorous concentration in the #08 Fernalds A and #08F Upstream were very high!
  (9/9/03): The total phosphorous level in Fernalds A (#18) was high.

SOUTH STATION

- **Monitor's Note (7/8/03):** Fernald "near farm" and whites grove were dry.
  (8/12/03): Sampling conducted after many days of overcast and rainy/thunderstorm weather.
  (9/12/03): Water seems unseasonably warm

USEFUL RESOURCES

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, *NHDES-WD 97-8*, NHDES Booklet, (603) 271-3503.

Camp Road Maintenance Manual: A Guide for Landowners. KennebecSoil and Water Conservation District, 1992, (207) 287-3901.

Comprehensive Shoreland Protection Act, RSA 483-B, WD-SP-5, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-5.htm.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/wmb/wmb-10.htm.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-1.htm

Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or www.des.state.nh.us/factsheets/wqe/wqe-7.htm

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, *WD-BB-9*, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-9.htm.

Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf.

Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-2.htm.

Road Salt and Water Quality, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm.

Sand Dumping - Beach Construction, *WD-BB-15*, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-15.htm.

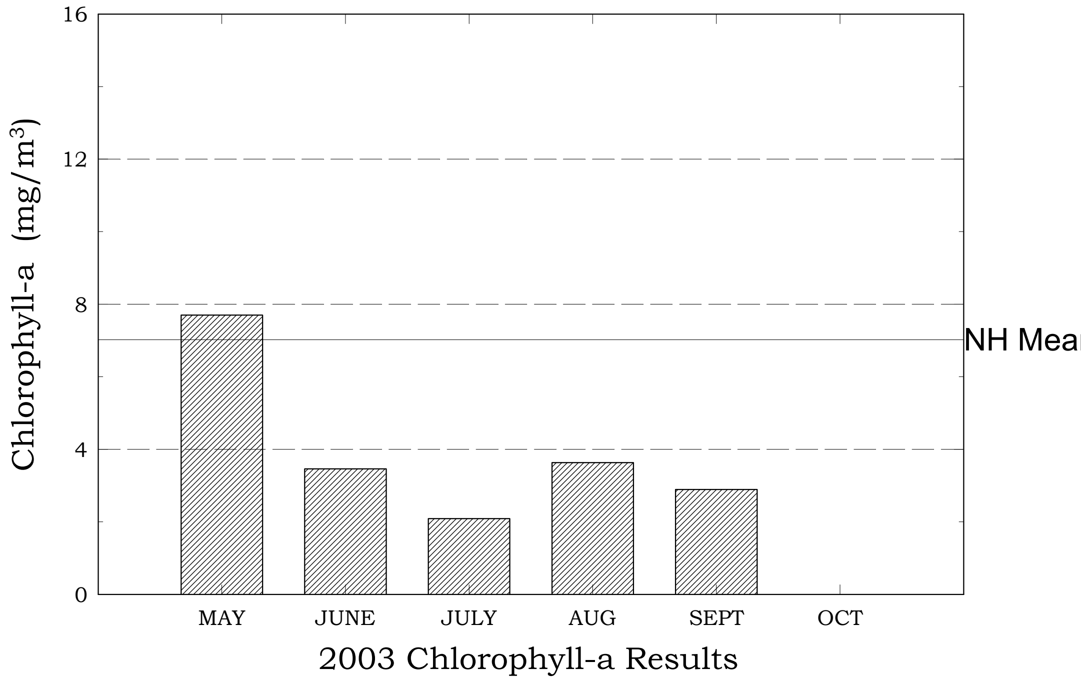
Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-4.htm.

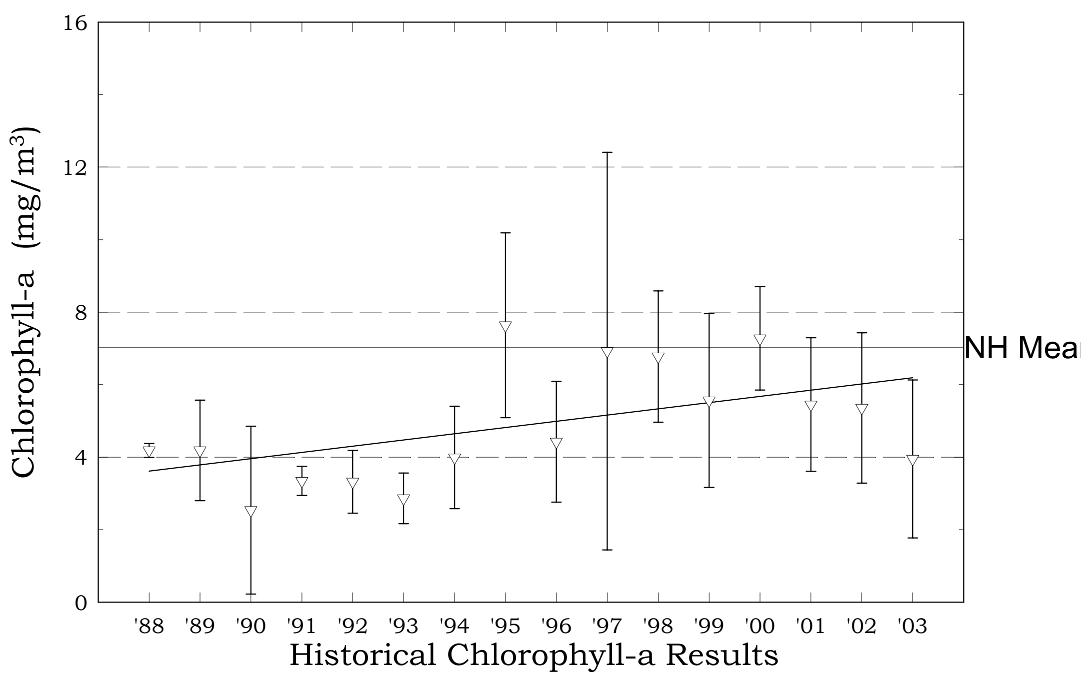
APPENDIX A

GRAPHS

Pawtuckaway Lake, North, Nottingham

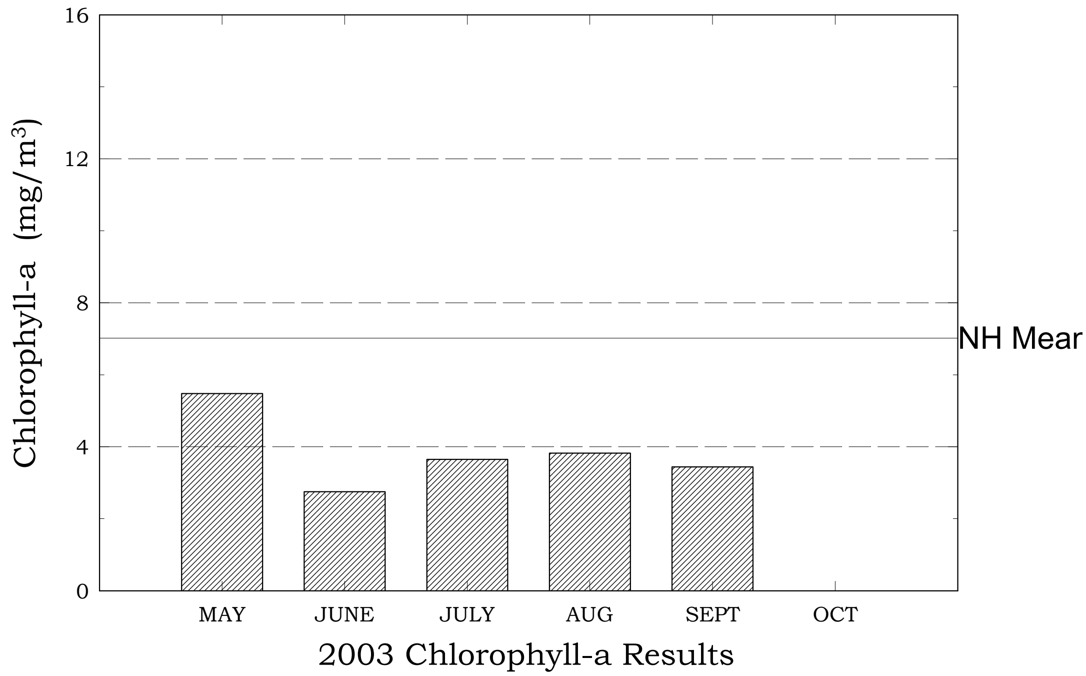
Figure 1. Monthly and Historical Chlorophyll-a Results

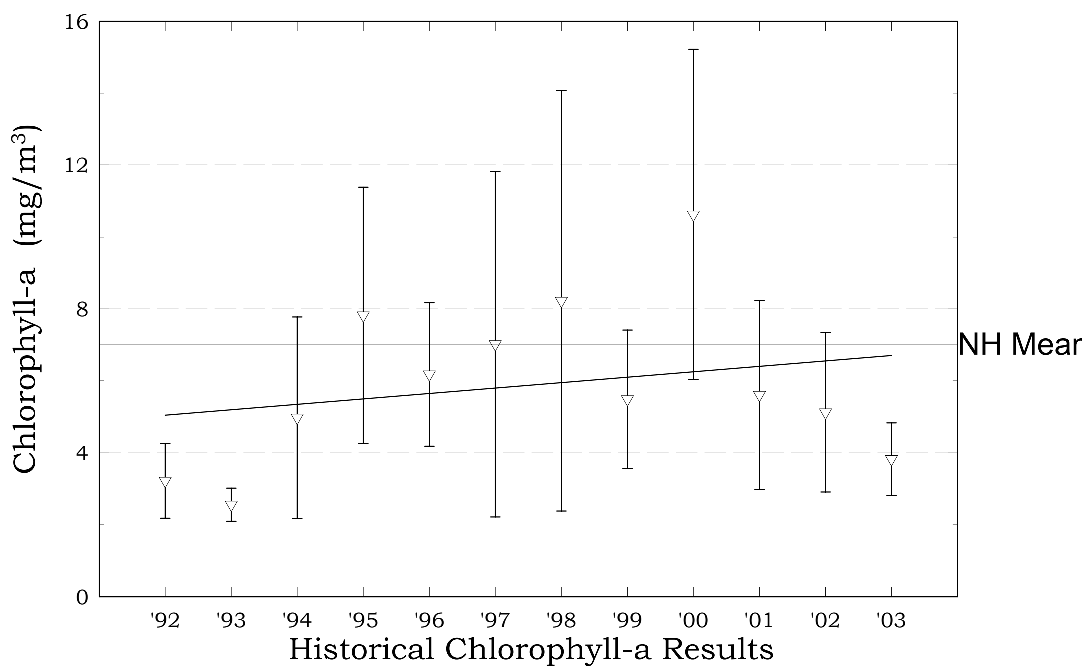




Pawtuckaway Lake, South, Nottingham

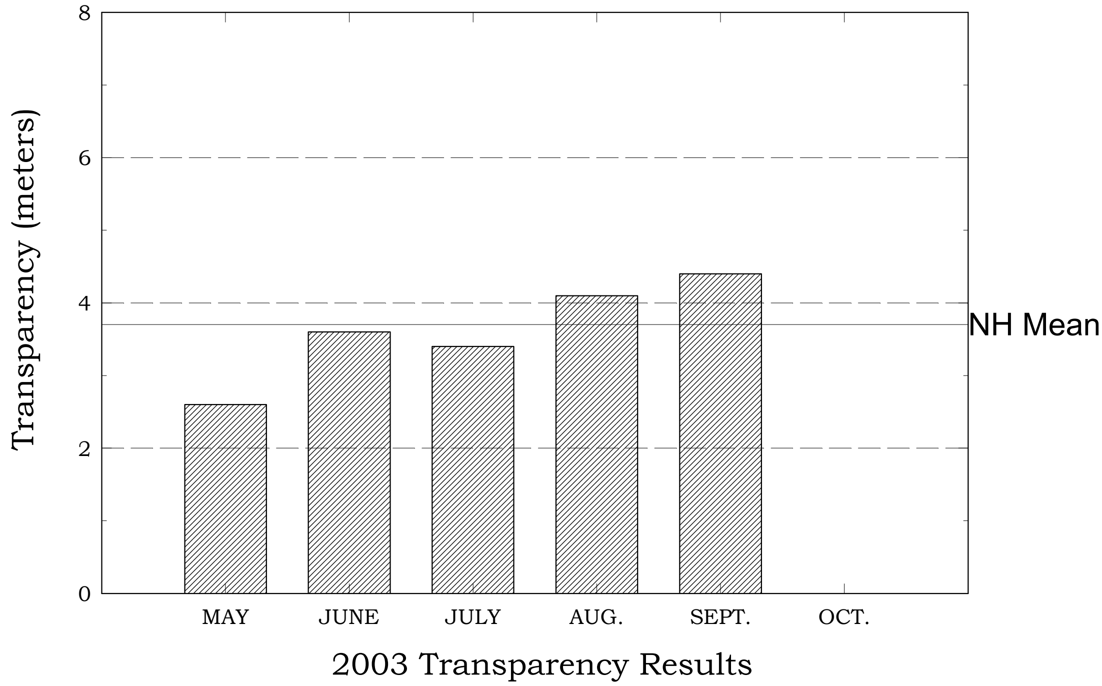
Figure 1. Monthly and Historical Chlorophyll-a Results

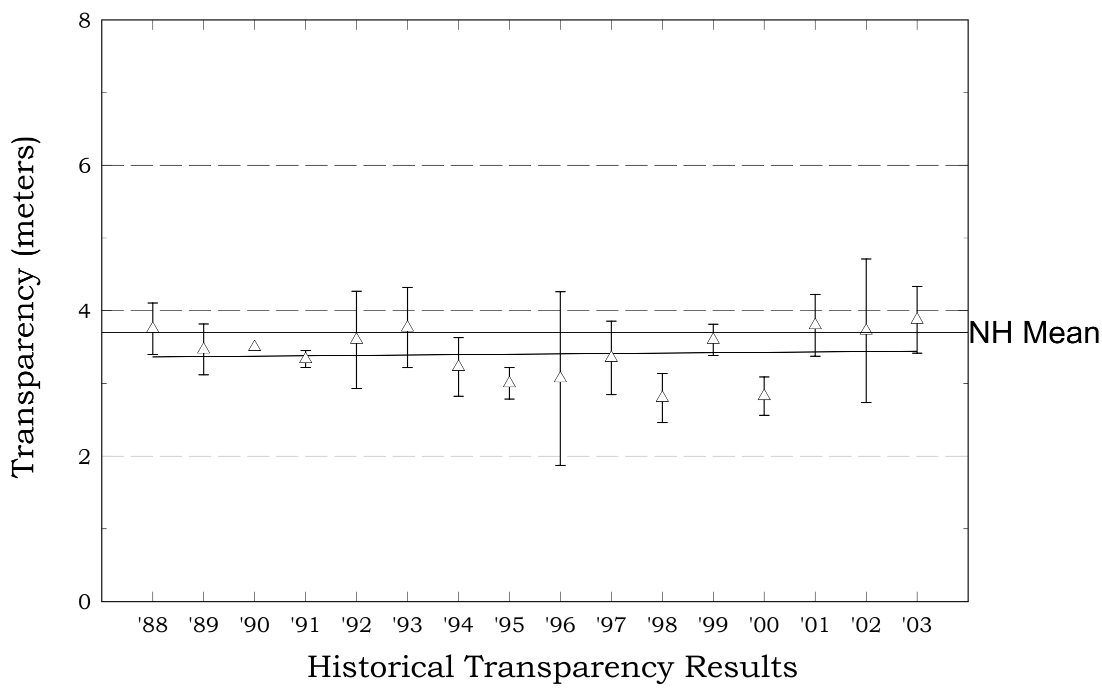




Pawtuckaway Lake, North, Nottingham

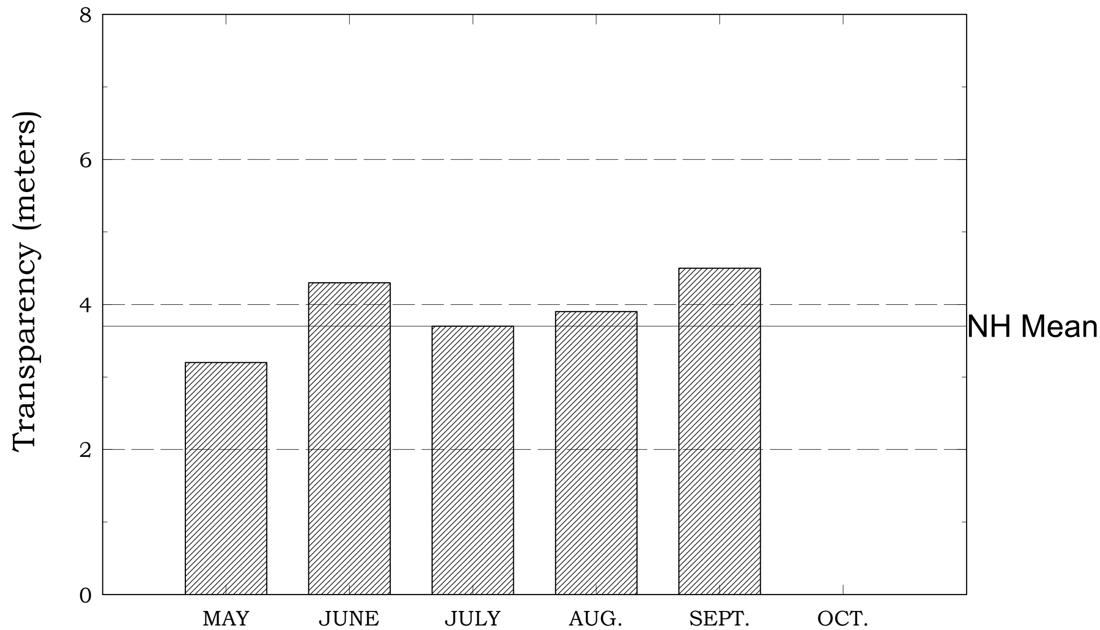
Figure 2. Monthly and Historical Transparency Results



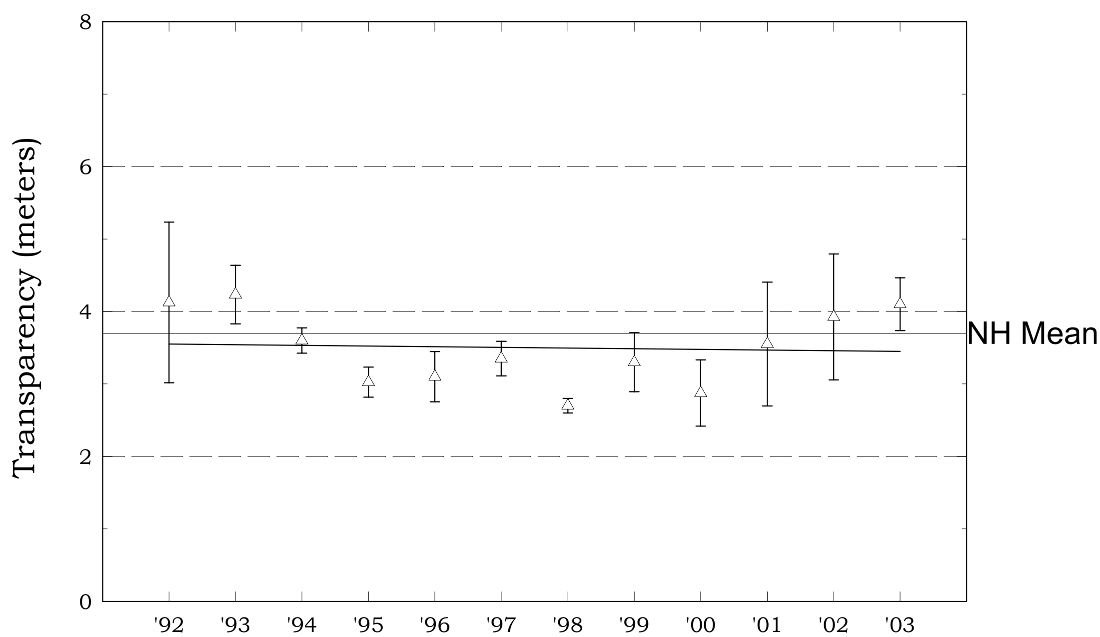


Pawtuckaway Lake, South, Nottingham

Figure 2. Monthly and Historical Transparency Results



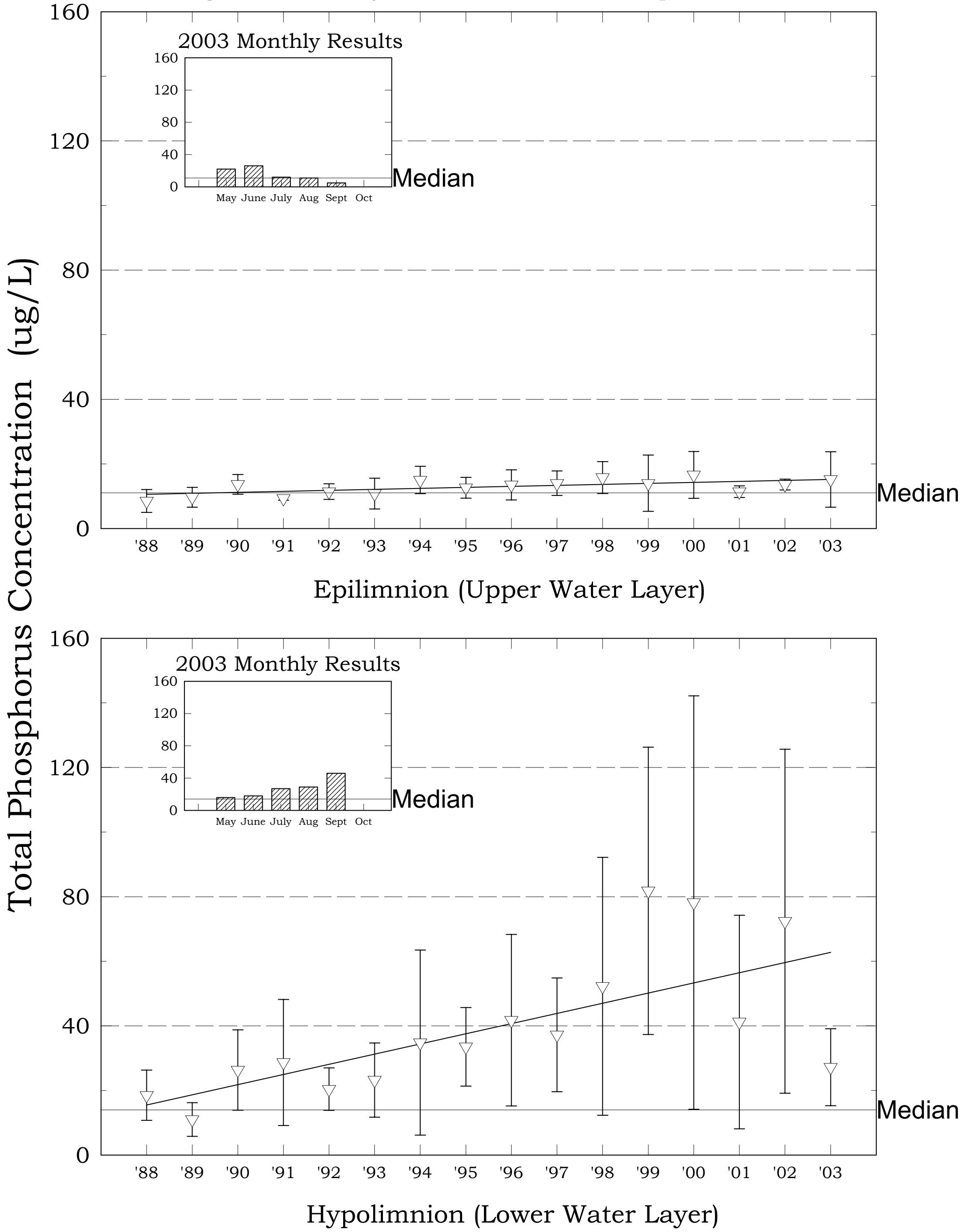
2003 Transparency Results



Historical Transparency Results

Pawtuckaway Lake, North, Nottingham

Figure 3. Monthly and Historical Total Phosphorus Data.



Pawtuckaway Lake, South, Nottingham

Figure 3. Monthly and Historical Total Phosphorus Data.